Southwestern Geographer
Vol. 8, 2004, pp. 1–33

Intraurban Mobility and Metropolitan Spatial Structure

Tae-Kyung Kim, Mark W. Horner, and Hazel A. Morrow-Jones

In developed nations, a dominant trend has been the decentralization of residential locations, as many perceive suburban locations as being able to offer better neighborhood and housing opportunities. Despite this trend, however, others still choose residences in central urban areas, as these places offer access to a diverse set of activities. This article analyses factors correlated with intraurban residential mobility. The most important determinant of inward migration is accessibility to population centers, while that of outward migration is residential characteristics and school quality. People's differing life stages may account for contrasts in the factors driving inward and outward migration. *Key Words: intraurban migration, residential mobility, urban growth, GIS, Franklin County, Ohio.*

Urban researchers are currently faced with understanding problems caused by imbalanced growth of urban versus suburban areas. The decentralization of residences and employment resulting from suburbanization processes during the last few decades has changed the way cities operate (Stern and Marsh 1997). Arguably, decentralization has led to deterioration or stagnation in central cities (Immergluck 2001; Sanchez and Dawkins 2001), environmental hazards (Main *et al.* 1999; Johnson 2001), and increased commuting costs for residents (Fernandez 1994; Brueckner and Martin 1997; Martin 2001). Furthermore, social tensions and segregation may both result from and exacerbate decentralization processes (Grubb 1982; Fong and Shibuya 2000; Timar and Varadi 2001).

Tae-Kyung Kim is a researcher with the Urban and Regional Planning Research Division of the Korea Research Institute for Human Settlements, 1591-6 Kwanyang-Dong, Dongan-Gu, Anyang-Si, Kyunggi-Do, 431-712, South Korea. E-mail: tkkim@krihs.re.kr. Mark W. Horner is Assistant Professor in the Department of Geography, Florida State University, Room 323 Bellamy Building, Tallahassee, FL 32306. E-mail: mhorner@fsu.edu. Hazel A. Morrow-Jones is Associate Professor in the Center for Urban and Regional Analysis (CURA), and Department of City and Regional Planning, Austin E. Knowlton School of Architecture, The Ohio State University, 278a Brown Hall, 190 W. 17th Ave., Columbus, OH 43210. E-mail: morrow-jones.1@osu.edu.

Still, the trend of urban decentralization is not absolute. Although the majority of movers relocate to more distant locations (Bier and Howe 1998), a substantial minority moves toward the center of the metropolitan area (Burnley and Murphy 1995; Stoll *et al.* 2000; Cho 2001; Leichenko 2001; Margulis 2001). Accessibility to activity centers, employment agglomerations, and cultural opportunities are thought to drive this inward shift (Cervero *et al.* 1999; Cervero 2001; Nylund 2001; Wang 2001; Morrow-Jones 2002). Understanding the interplay between urban structural characteristics and inward/outward mobility flows is a primary concern for planners and other urbanists.

This article explores both inward and outward residential mobility flows within a metropolitan county. A spatial-analytic framework incorporating statistical models with geographic information systems (GIS) is implemented for analyzing intraurban movement using repeat homebuyers in Franklin County (Columbus), Ohio, as a case study. We use multiple linear regression to model relative location change in the metropolitan area as a function of differences in spatial characteristics of the origin and destination home and neighborhood. Inward and outward migration are analyzed separately, but the same variables are used in each model to allow for comparison of the structural forces important in each set of flows. Outward movers are defined as those who have moved *farther* on a relative basis from the central business district (CBD). Inward movers are those who relocate *closer* to the CBD on a relative basis. For each group of migrants, we define both neighborhood and unit variables to model the effect of urban structure on the magnitude of the move. Basically, our efforts will contribute to an understanding of how current urban structure, as represented by our independent variables, influences the magnitude of the distance moved by repeat homebuyers whether they move toward the center of the metropolitan area or away from it.

One might suspect that many U.S. cities of today are highly polycentric rather than monocentric. To base an entire analysis on whether people moved closer to or farther away from the center arguably disguises the rich variety of reasons for moving around in urban space. However, with a strong CBD and nearby university, Columbus has a relatively stronger center than most U.S. urban areas. Furthermore, with the concrete results of this simple monocentric framework, we believe that it could be extended to analyze more diverse moving patterns in different urban settings.

The following sections develop a conceptual framework and review of the literature, a description of the data and our methodology, and the results of our analysis. In the final section we discuss the results, provide conclusions, and make suggestions for future research.

Literature Review

Urban areas are in a continuous state of growth and emergence, where various elements, including people, space, facilities, transportation networks, and neighborhoods, are in perpetual transformation. One part of this transformation involves the expansion of people and development into more peripheral locations that form separate suburban jurisdictions (Levy 1994; M'Bala 2001). One way to understand this evolutionary process is to examine two broad, opposing influences called *centrifugal* (pushing outward) and *centripetal* (pulling inward) forces (Benguigui *et al.* 2001; M'Bala 2001). These forces are related to structural characteristics of urban space, such as the location of more expensive housing and better schools (Morrow-Jones 1998). Thus, the characteristics of different locations may attract or repel people and will play out as centripetal or centrfugal movement.

Several areas of research have considered locational characteristics both as centrifugal and centripetal factors. Push factors in the intraurban context, such as deteriorating neighborhood housing conditions (Cribier and Kych 1992; Austin 1999) and lack of labor and social capital (Berger 1996; Sundari and Rukmani 1998; Benguigui *et al.* 2001; Khan *et al.* 2001), are negative considerations that might encourage people to relocate not just away from the problem but at a larger distance as these conditions grow in severity. Conversely, pull factors, such as active communities with cultural opportunities (Burnley and Murphy 1995), well equipped schools (Dwyer and Sutton 1994), and lower taxes (Tiebout 1956), are characteristics that might attract movers from farther away the more advantageous they are. Some factors can arguably act as either a pushes or pulls on migrants. For example, higher population growth in a given locale can be construed as an attraction because, on the one hand, movers may interpret such conditions as indicative of there being plentiful job opportunities or an agglomeration of central facilities (Palivos and Wang 1996; Krugman 1999). On the other hand, higher population-growth rates can act as a centrifugal force if they are perceived as generating negative externalities such as congestion or denser land use (M'Bala 2001).

Locations in metropolitan space present a suite of push- and pull-factors to the potential mover, which will be evaluated differently by movers. Although movers' personal circumstances or perceptions may render certain characteristics of communities more or less attractive, the structure of the characteristics themselves is the same for all movers. This article emphasizes the structure of place characteristics available in two broad classes of push- and pull-factors that vary across space: (1) property-specific variables, such as the characteristics of the building, lot, and tax rate; and (2) neighborhood variables, such as the school district location and other community characteristics that reflect the lifecycle concerns of the people in these areas.

Intrametropolitan moves are most often driven by housing needs and neighborhood conditions, such as school quality (Morrow-Jones 1998, 2002). For homeowners, an owner-occupied home is likely to be the largest single investment in the household's portfolio (Adams 1984), and thus, those households have additional concerns for the resale or investment value of the home as well as its comfort and usability. Homeowners' characteristics of the location are important to the enjoyment of the home and possibly even more important to its investment value. Other structural aspects of urban areas, such as owner-occupation rates, and income-growth rates of neighborhoods, may also be important as people look for locations with certain kinds of images and the potential for increases in value.

The residential characteristics available at different locations in the metropolitan area help to structure the moves that homeowners make. For example, Bier and Howe (1998) argue that homeowners who want to move up in price are almost inevitably forced to move outward. Highly valued amenities, such as low population density and public green space are also not equally available everywhere in metropolitan regions (Tyrvainen and Vaananen 1998; Smith *et al.* 2002). Households with children may focus on school characteristics and quality, both of which have important variations across metropolitan areas (Haurin and Brasington 1996; Brasington 2001). Even households without children may pay attention to this variable because it can improve the value of their investment. Additionally, property-tax rates also influence people's movements. Tiebout's (1956) argument that movers choose the combination of taxes and services that best serves their interests remains a classic in the field. To the extent that tax rates are spatially variable, they may also affect movement patterns.

The population and life-cycle characteristics of parts of the metropolitan area are another structural component affecting movement patterns. For example, family-oriented neighborhoods, or those with socially active single people are not equally distributed across the urban area. Thus, the pattern of distance and direction of residential moves may reflect the spatial structuring of the population with particular characteristics as well as the other factors mentioned above.

The characteristics of the housing stock will vary across space, and different parts of that stock will be a better or worse fit for subgroups of moving households. Different spatial attributes should be attractive to different households, and there are distinct patterns to those attributes. This suggests that decentralization is not an absolute trend, but a selective process. An understanding of the degree to which some place characteristics are associated with outward movement and others are associated with inward movement can inform theory as to how spatial structure affects mobility and provide a better basis for policy formation.

The research reviewed here demonstrates the breadth of approaches to understanding the implications of urban structure for centrifugal and centripetal forces in urban evolution. Dwelling and neighborhood quality, as well as population characteristics of areas, have been emphasized here, though there are many other characteristics that could be examined. The work reviewed, however, does not focus on the measurement of magnitude of centripetal and centrifugal forces explicitly, nor does it seek to precisely measure and model the interaction of those forces and the factors generating these forces (urban structure). Our work lays a foundation for understanding the relationship between residential relocation movement and characteristics of urban spatial structure. This will provide the basis to eventually bridge the gap between research emphasizing the characteristics of individual movers and the larger urban structure that determines the set of locations from which those movers may choose.

Conceptual Framework

Relative Intraurban Migration

To get at the structural factors associated with centrifugal and centripetal forces in intraurban migration, we define households' residential location changes relative to the central business district (CBD). This is accomplished by using the distance differential to the CBD calculated relative to the households selling *(S)* and buying *(B)* residences from a sample of repeat homebuyers within the region. We selected a functional center of the CBD of Columbus, Ohio, which is the intersection of High Street and Broad Street. Using the household's change in location relative to the CBD is a different approach than that employed in most previous work on the topic of intrametropolitan migration (see Eaglstein and Weisberg 1990; Nelson 1999; Roseman and Lee 1998). Some researchers have engaged in origin/destination modeling of migration, but this has been performed at far more aggregate scales. For example, Manson and Groop (2000) work at the inter-county level, while Lee and Roseman (1997) and Roseman and Lee (1998) work at the interstate level. Our study focuses on shifts between specific addresses within one county; thus, we are able to specifically discuss the impact of urban structure. Movement between states tends to be determined by somewhat different factors such as kinship or economic opportunities. These studies also model absolute migration distance between origin/destination locations, whereas we deal with the *relative distance* between the current and prior properties in the context of a single urban region.

In our method of calculating this relative move distance, *D* takes on positive values for cases of movement that go outward relative to the CBD, and negative values in cases where the move takes the household closer to the CBD (Figure 1).

To illustrate, if the purchased house associated with an observation was ten miles from the CBD (y=10) while the house sold was five miles from the urban center (x=5), net outward movement would be +5 miles. Distances are depicted as straight lines to illustrate the concept, but in the analysis, street network lengths are used, since they better represent the real-world situation. People generally perceive driving distances, rather than straight-line distance, as the true degree of spatial separation because they are a function of time (Magdol 2000; Kim and Chung 2001).

Our framework assumes that the CBD is *the* most attractive urban destination due to its concentration of activities. Although the center of the CBD itself might not be an attractive place, people are likely to accrue some benefits by moving closer to the CBD, such as proximity to concentrations of jobs and activities.

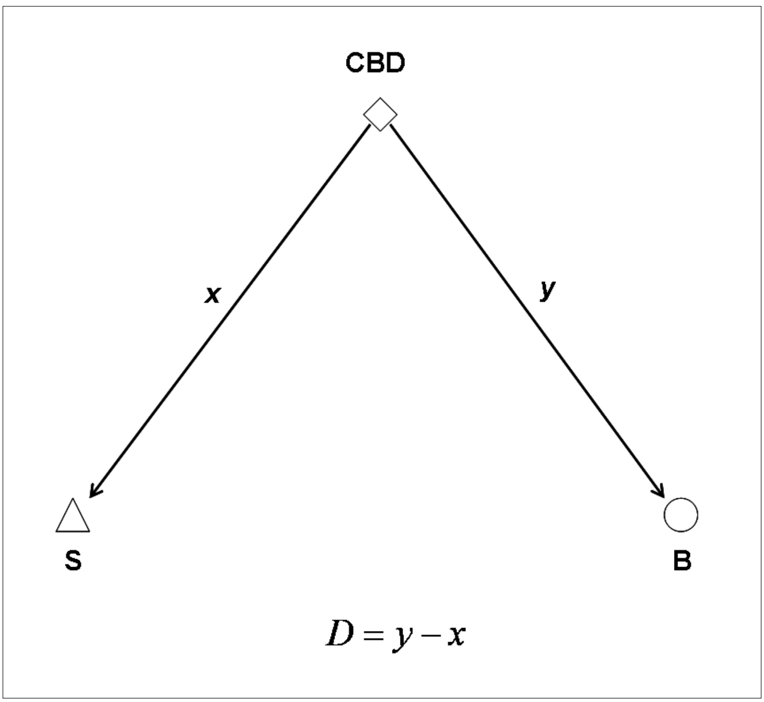

Figure 1. Dependent variable.

Again, we are interested in capturing the degree to which households relocate relative to this important location. If a household moves outward from the CBD, we refer to this as Outward Migration Force (OMF). Conversely, if the resident moves inward towards the CBD, we talk about Inward Migration Force (IMF). The next section provides more specific definitions of these two concepts.

Migration Force

We express the relative difference in distance from the CBD (depicted in Figure 1) as a Migration Force (MF). This metric captures the *magnitude* of the relative movement for both the cases of inward (IMF) and outward (OMF) migration forces (Figure 2). IMF is defined when people move nearer to the CBD, while OMF occurs when people move farther from the CBD. It is possible for some cases to have *negative* values of MF (that is, the household has moved into the CBD). This will occur if the house sold *(S)* is further from the CBD than the house bought *(B)*. The sign of the migration force is used to separate records into those with IMF and those with OMF. The positive distances are assigned to OMF and the negative distances to IMF to create the two dependent variables for our regression analyses. After making this separation, the absolute value is taken so as to always model positive distances.

Besides capturing the degree to which a mover has moved closer to or farther from the CBD as a result of relocation, this assessment of intraurban movement also approximates a measure of the household's transition to areas of differential *accessibility*. For those moving closer to the CBD, we claim that accessibility is being gained—that is, the mover will be closer to a larger agglomeration of people and economic activities. For those moving outward from the CBD, access is generally being lost. This is consistent with classical bid-rent theory, as land prices peak in the CBD with the most accessible locations and decrease outward from the central city (Alonso 1964).

To check the extent to which our assumption of peak accessibility at the CBD holds up for the study area, we examined an accessibility index using population in Franklin County, Ohio. Such indices stem from the seminal work of Hansen (1959)

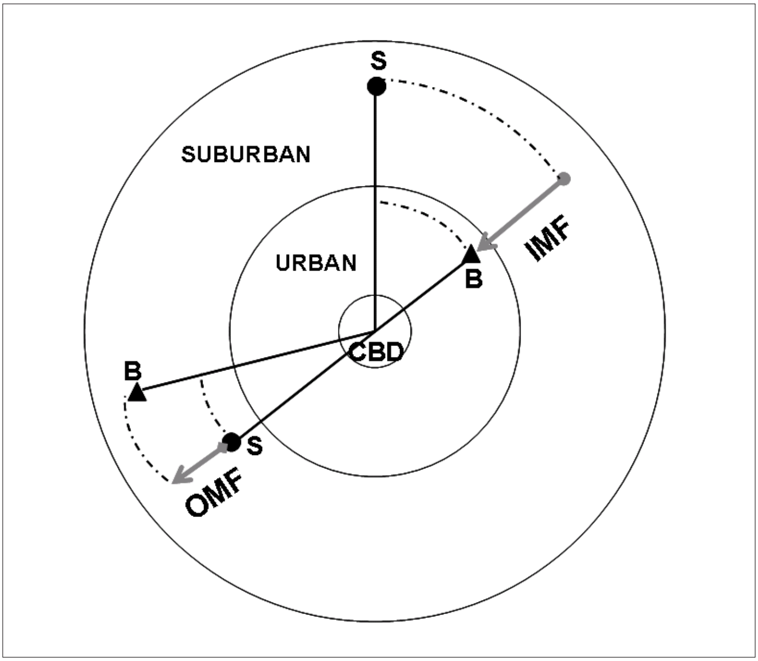

Figure 2. Concepts of IMF and OMF.

and Harris (1954), and are still widely used today in urban analysis (see Allen *et al.* 1993; Levinson 1998; Wong *et al.* 1999; Adair *et al.* 2000; Horner and Grubesic 2001; Shen 2001). The basic concept of the accessibility or potential index is that the influence of activities on a certain point *decreases* as distance from the point increases.[1]

When examples of several inward and outward moves are superimposed on the accessibility surface, it can be seen that the potential index for Franklin County is highest in the most central locations (Figure 3). Thus, gains in accessibility to population are realized for those moving closer to the CBD. Conversely, accessibility is generally lost for those moving further away. The map also points to some heightened areas of accessibility around the suburban fringe, which is consistent with prior research (see Wang 2001), though the general trend is decreasing accessibility potential moving away from the CBD. In spite of recent suburban growth

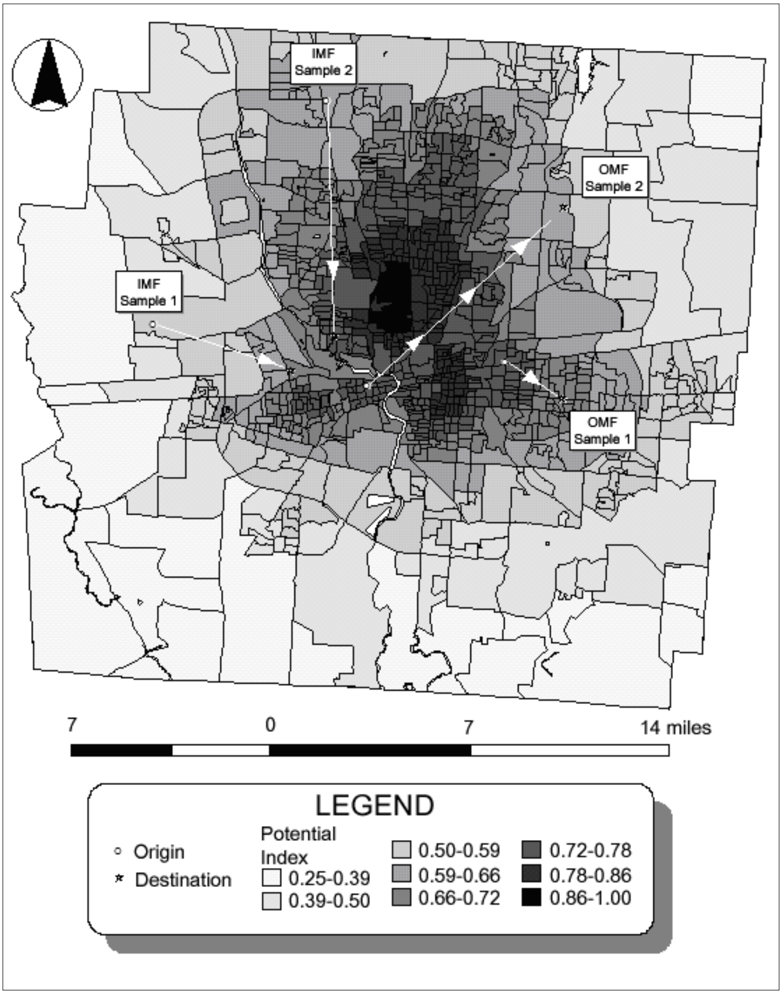

Figure 3. Potential index with examples of in- and out-migration.

(Ding and Bingham 2001; Shen 2001), the Columbus CBD is still the point of highest accessibility in the metropolitan area. Thus, in the context of our research, we make the simplifying assumption that moving nearer to the CBD increases accessibility, while moving further from it decreases accessibility. In future studies, more detailed analyses using several job/activity centers, can be undertaken, but the focus here is on developing the concept of migration force and testing its association with urban structure variables.

Data

The data set used in this analysis is derived from deed-transfer records for the Columbus metropolitan area. Deed transfers were matched by buyer and seller name to create cases of households who had sold one home and bought another within the area in one year (1998). The data set includes exact property addresses and the Franklin County Auditor's parcel identification codes. It was compiled by the Center for Urban and Regional Analysis (CURA) at The Ohio State University in digital format and is easily referenced using commercial GIS. From this database, we selected only those cases in which both the house bought and the house sold were in Franklin County, the central county of the Columbus metropolitan statistical area. This resulted in a set of 2,162 cases. The number of records was further reduced to 1,209 matched buyer/seller transactions after including only single-family residential dwelling transactions. For clarity, we selected only single-family dwellings, as other dwelling types are a relatively small portion of this database.

Two commercial GIS programs (ArcView 3.2 and TransCAD 3.2) were used to manage the transaction database and perform analytical tasks. Using a common property-indexing scheme designed by the county auditor, we added parcel information to the transaction database from the Franklin County Auditor's GIS database. Neighborhood characteristics were obtained from census data at the block-group level. Estimated census data for 1997 from the Caliper Corporation (www.caliper.com) were utilized under the assumption that people behaved in 1998 according to their knowledge of neighborhoods in 1997. This seemed the best alternative, as 2000 census data at this scale had not been released at the time of this research. Data from the 2000 census combined with 1990 data would have allowed interpolation of values for 1997 or 1998; however, the 1997 estimates of the census are satisfactory for modeling intraurban movement.

This combined data set (transaction database, county auditor file, and census data) is unique in its ability to provide a specific source of neighborhood and housing-unit information with relatively large geographical coverage. The combination of housing-unit and neighborhood variables allows us to perform a more complete analysis. Using the synthesized database, we are able to also examine whether some subsets of variables have more explanatory power than other groups. For instance, we can look at whether neighborhood factors, such as local economic and demographic characteristics, add explanatory power to the model beyond that which can be achieved using only property-specific variables. This is important as it allows us to test for the influence of geographic aspects of urban structure on intraurban mobility.

Variables

The independent variables used to explain the magnitude of people's movement relative to the CBD or their migration force (MF) in this analysis are grouped into two categories: housing-unit variables and neighborhood variables. The unit variables represent individual housing-unit characteristics such as the number of rooms, the age of building, the ratio of the building size to the lot it is set on, and its property-tax rate. Neighborhood variables include characteristics such as the population density, population-growth rate, median household income, income-growth rate, demographics, occupational structure, and housing-occupancy rates of the block group, and location characteristics such as the school districts in which the properties are located.

Our use of school districts in this analysis requires further explanation. The magnitude of inward- or outward-movement may be partially explained based on the structure of property-tax revenues, school quality, and other school characteristics in the urban area (Margulis 2001; Weimer and Wolkoff 2001). In Ohio, public schools receive state support but are heavily dependent on local property taxes. In fact, this is the single largest expenditure of local property-tax revenues in most communities. To test for the structural effects of these characteristics, we group school districts in Franklin County into three categories: one urban district (City of Columbus), four inner-suburban districts (Upper Arlington, Grandview Heights, Bexley, and Whitehall), and several outer-suburban districts (Dublin, Worthington, Westerville, New Albany, Gahanna, Summit Station, Reynoldsburg, Pickerington, Canal Winchester, Ashville, Groveport, Grove City, London, Hilliard, and Plain City). School district boundaries do not exactly correspond to the municipal boundaries. For example, a township may provide funding for one or several school districts. On the other hand, the urban school district is mainly supported by the City of Columbus.

We separated suburban school districts into two classes (inner and outer) because of several important differences in their structures. Inner-suburban school districts are associated with older suburbs that are completely built out (or very near that point). The level of support for these schools is almost entirely dependent on taxes paid by homeowners as the suburbs have relatively little retail and commercial property. The inner suburbs are closer to the CBD and in several cases have high quality older housing that attracts those who value such properties with mature landscaping in addition to accessibility and suburban schools. The outer suburbs, on the other hand, are much newer and still growing. Several of them have very strong commercial and retail tax bases, making it easier to provide services and pay for high quality schools. Their accessibility is weaker to the CBD but stronger to the edge agglomerations of jobs and shopping. Although there are important differences within the two sets of suburbs, for our purposes the primary distinctions between them (differences in accessibility, property-tax revenues, and the likely growth in those tax revenues) are crucial. We deal with intraurban movement among the three groups of school districts, using eight paired dummy variables with the comparison category being the urban-to-urban move (*i.e.*, a move within the City of Columbus school district) (Table 1).

Descriptive Statistics

Descriptive statistics (mean values) for several variables of interest for both in-movers (IMF) and out-movers (OMF) are taken from our combined database on residential relocation in Franklin County (Table 2). Recall that for in-migration, people's relative distances from the CBD have decreased after taking into account their prior location. Conversely, for out-migrants, distance from the CBD has in-

From		To	
U	City of Columbus	IS	Upper Arlington, Grandview, Bexley, Whitehall
		OS	Dublin, Worthington, Westerville, New Albany, Gahanna, Summit Station, Reynoldsburg, Pickerington, Canal Winchester, Ashville, Groveport, Grove City, London, Hilliard, Plain City
IS	Upper Arlington, Grandview, Bexley, Whitehall	IS	Upper Arlington, Grandview, Bexley, Whitehall
		OS	Dublin, Worthington, Westerville, New Albany, Gahanna, Summit Station, Reynoldsburg, Pickerington, Canal Winchester, Ashville, Groveport, Grove City, London, Hilliard, Plain City
		U	City of Columbus
OS	Dublin, Worthington, Westerville, New Albany, Gahanna, Summit Station, Reynoldsburg, Pickerington, Canal Winchester, Ashville, Groveport, Grove City, London, Hilliard, Plain City	IS	Upper Arlington, Grandview, Bexley, Whitehall
		OS	Dublin, Worthington, Westerville, New Albany, Gahanna, Summit Station, Reynoldsburg, Pickerington, Canal Winchester, Ashville, Groveport, Grove City, London, Hilliard, Plain City
		U	City of Columbus

Table 1. School districts dummy variables.

creased after taking into account the prior location.

The first part of Table 2 includes average values for individual parcel characteristics relative to properties bought and sold. Both in- and out-movers chose larger properties in terms of both the building and lot size. When the ratio of the building size to the lot size is taken, in-movers (IMF) tend to lose lot area relative to house size, while for out-movers (OMF), land area increases faster than the house size, so the ratio decreases. This observation follows from the fact that lot sizes increase with increasing distance from the CBD. In- and out-movers moved to larger homes, and both also moved to more expensive properties on which

Table 2. Descriptive statistics.

IMF Model (408 Cases)		VARIABLES	OMF Model (801 Cases)	
SOLD	BOUGHT		SOLD	BOUGHT
		Parcel Information		
1669.96	1983.13	Building Size (square feet)	1554.16	2068.72
10183.97	11732.98	Lot Size (square feet)	9193.35	13054.25
0.188	0.211	Building to Lot Size Ratio	0.203	0.190
104793	128912	Building Value ($)	96336	135066
31090	43312	Lot value ($)	28849	39910
135882	172224	Appraised Total Property Value ($)	125185	174976
6.50	6.98	Number of Rooms	6.21	7.18
2471.54	3140.68	Annual Property Tax ($)	2178.59	3202.53
1.77	1.78	Annual Property Tax Rate	1.69	1.79
1967	1959	Year Property Built	1959	1972
24	28	Property in Urban School District (%)	42	19
15	32	Property in Inner-Suburban School Districts (%)	15	14
62	40	Property in Outer-Suburban School Districts (%)	43	67
		Neighborhood Information		
4369.29	4472.64	Population Density (# of Persons/square mile)	5267.83	3724.61
16.51	8.55	Population Growth Rate (%, 90-97)	7.30	17.50
60510.17	64489.90	Median Households Income ($)	51273.93	65959.57
34.68	36.25	Median Income Growth Rate (%, 90-97)	35.97	35.22
89.8	90.5	Ethnicity (%, White/pop)	86.9	90.6
26.2	24.4	Youth Population (%, 18 Under/pop)	24.6	26.1
11.1	13.2	Elderly Population (%, 65 and Over/pop)	12.2	10.3
45.3	45.3	Married Population (%, Married/pop)	41.7	46.7
39.5	44.9	Education (%, College+ Educated/25 and + pop)	33.9	41.0
38.4	43.3	Occupation (%, White Collar/Employed pop)	34.4	40.2
96.1	95.3	Housing Occupancy Rate (%, Occupied/HU)	95.0	95.8
72.1	71.8	Housing Owner Occupancy Rate (%, Owner Occupied/HU)	65.1	73.2
		Distances		
4.86 mile		Average Distance between Properties Sold and Bought (absolute value)	5.50 mile	
7.20 mile		Average Distance between Purchased Properties and the CBD	9.96 mile	
9.36 mile		Average Distance between Sold Properties and the CBD	7.31 mile	

higher taxes are paid. When tax rates are estimated by dividing the annual tax paid by the appraised property value, outward movers are shown to pay the higher rate on average. These higher tax rates are partially due to school funding needs in suburban locations, where residents pay higher tax rates in exchange for better school quality. Inward migrants tended to move to older houses, while outward migrants moved to newer houses. This is consistent with what we know about the spatial distribution of the housing stock in most urban areas and in the Columbus metropolitan area in particular. The remaining parcel information describes the

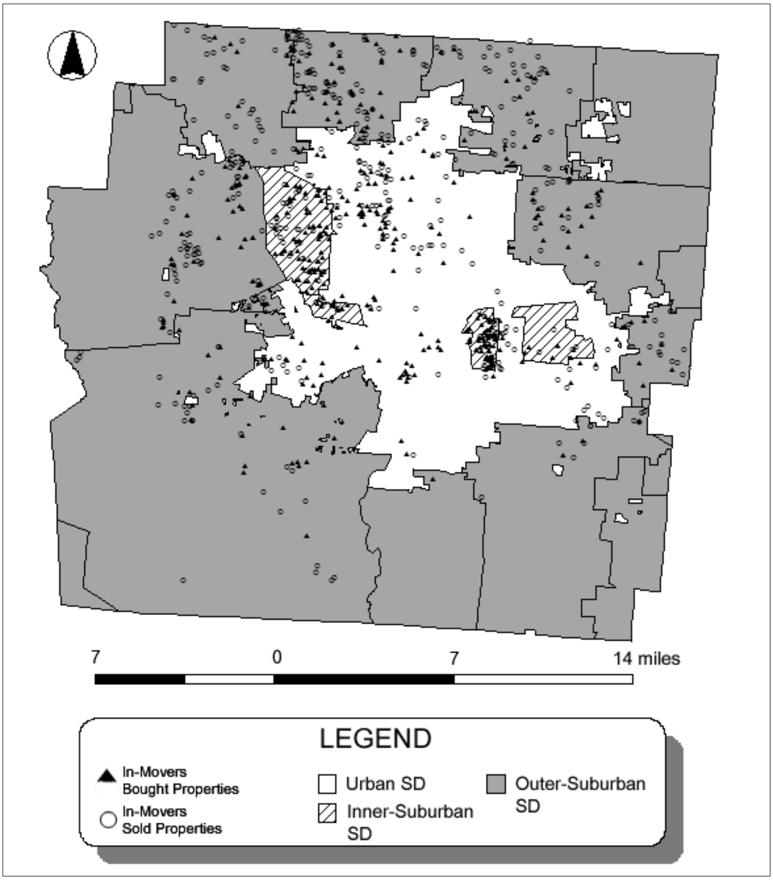

Figure 4. In-migration patterns, with school districts.

percentages classified as being located in urban, inner-suburban, or outer-suburban school districts. Figures 4 and 5 show the spatial distribution of inward movers and outward movers, respectively, relative to the classes of school districts.

The second part of Table 2 includes neighborhood characteristics derived from census variables. As we would expect, inward migrants chose houses in more densely populated neighborhoods (census block groups are our definition of neighborhoods) with lower growth rates, while outward migrants chose properties in less dense, higher growth areas. Both mover groups moved to areas of greater

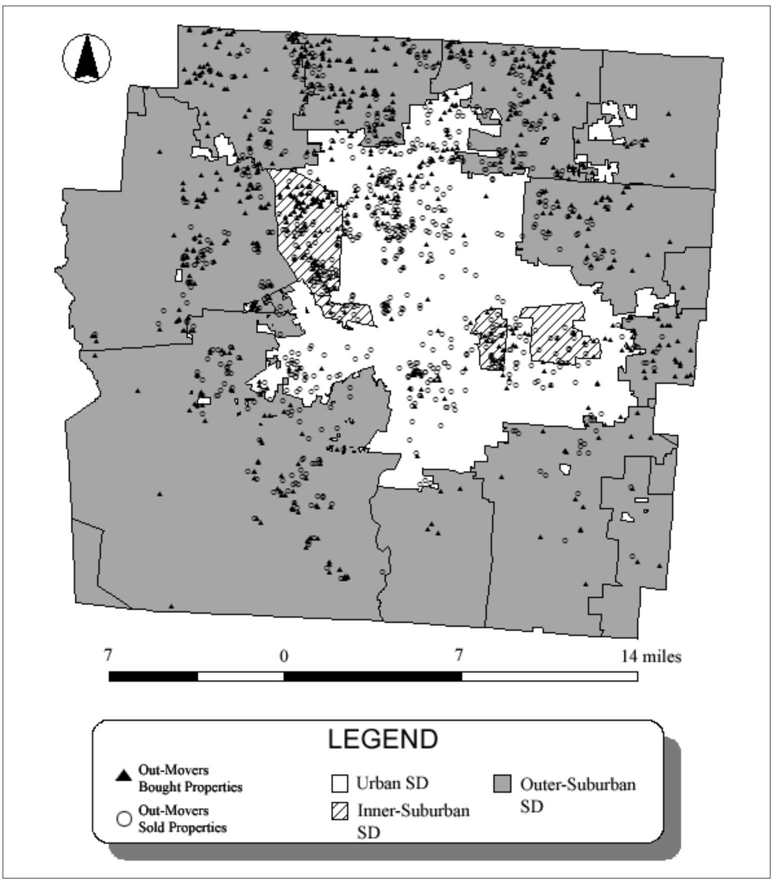

Figure 5. Out-migration patterns, with school districts.

economic affluence (as measured by median family income) compared to their prior location. In terms of racial composition, both groups moved to neighborhoods with higher concentrations of white population, with outward movers seeing the largest increase. Outward migrants moved to areas of more youthful population in contrast to the older population in the inward movers' new neighborhoods Not surprisingly, on average, the percentage of married-couple households was higher for outward movers, who saw a relatively large increase between their former and new neighborhoods (41.7 versus 46.7 percent). Neighborhood marriage statistics for inward movers did not change much. Both sets of movers ended their moves in areas of better educated, professionally employed residents. Inward movers bought homes in areas with slightly higher housing vacancies and more nearby rental properties than outward movers.

The last part of Table 2 shows the average distances moved by the inward and outward migrants (absolute values) and their relationship to the CBD. Outward movers moved longer distances than inward movers, but given the distribution of the population of possible movers we would expect that to be the case; there is more distance outward from the center of population than there is inward from it.

Model Specification

The housing and neighborhood characteristic variables presented above are used to model intraurban migration. Consistent with our prevailing argument, we hypothesize that factors captured by these variables describe structures of the urban area that act as push or pull factors on migrants' mobility patterns. As such, we would expect to see differences in the way these variables relate to people's migration outcomes. For example, we know that migrants chose more expensive homes on average. In our analysis, we would then be interested in knowing how relative distance moved related to price changes.

Model

Theoretically, obtaining better physical and community characteristics in terms of housing will increase the property owner's personal utility (Waddell *et al.* 1993;

Hite 2000; Lee *et al.* 2000; So *et al.* 2001; Strand and Vagnes 2001). Thus, there is motivation for the individual to seek out opportunities perceived as better than their current situation. However, the locations that meet these criteria follow from the spatial organization, or the structure, of the urban area. This affects the relative movement distances. We focus on modeling migration forces (IMF, OMF) as a function of the *change* in attributes (both housing unit and neighborhood) between the properties sold and bought. In notation, this is:

$$IMF = f(\Delta AH, \Delta AN) \tag{1}$$

$$OMF = f(\Delta AH, \Delta AN) \tag{2}$$

where

IMF : Inward-Migration Force $(\,|y - x|\,)$

OMF : Outward-Migration Force $(y - x)$

ΔAH : Differences in attribute values of the housing-unit variables for the units sold and bought

ΔAN : Differences in attribute values of the neighborhood variables for the locations sold and bought

All variables presented in this regression analysis are expressed in terms of the change in value from households prior to current residence. Using building size to illustrate in equations (1) and (2), a household's prior residence will have some value, A_p, as its total area, while their new residence will have A_n as its total area. Of interest is ΔA, or $A_n – A_p$. If ΔA is positive, then the mover selected a bigger house.

Model Results

The specifications discussed here are built with both housing-unit and neighborhood variables. Both sets of variables were included in the same model because they perform better together than using either group alone. A nested F-test was used to confirm that this was the case.[2]

Both IMF and OMF models have relatively high adjusted *R*-squared values, 0.660 and 0.607, respectively (values adjusted for degrees of freedom). This confirms that the measures of structural changes (changes in attributes between purchased and sold residences) of explanatory variables used in our model explain the magnitude of IMF and OMF quite well, and IMF slightly better than OMF. Among the initially considered variables (see Table 2), only selected variables are used after screening through colinearity test and model fit. Variable descriptions and the results of the IMF and OMF models can be seen in Table 3. To reiterate, all variables explained in this section are derived from the changes in attributes between the property sold and the one bought.

IMF Model: Housing-unit Factors

All unit characteristics, including the building-to-lot-size ratio, the number of rooms, the property-tax rate, and the year the housing structure was built are significantly related to IMF. Building-to-lot-size ratio enters the model with a positive sign, suggesting that inward-moves of greater magnitude entailed the purchased properties having larger buildings as compared to the lot size. Each of the other unit variables enter the IMF model with a negative sign, meaning larger moves towards the CBD are characterized by purchased houses having fewer rooms and lower property-tax rates than the homes sold. Longer distance moves towards the CBD are associated with relocation to significantly older properties as well. Of the unit variables, the change in property-tax rate seems be most important in accounting for the structure of inward movement, as evidenced by it having the largest absolute standardized coefficient (-0.177). This is consistent with classic Tiebout theory in that migrants are sensitive to the intraurban structure of property-tax rates and costs of public goods (Tiebout 1956). It should be noted that the building or lot size itself is not used in our model because the number of rooms already incorporates the characteristics of the size variables. Analogously, value terms such as property value or total property tax paid are not used because other physical size (number of rooms) or condition (year property built) variables captures these effects.

Table 3. Model results.

IMF Model (Adj. R^2 = .660)					OMF Model (Adj. R^2 = .607)			
Unstandardized Coefficient	Std. Error	Standardized Coefficients *beta*	t-value	Variables (bought - sold)	Unstandardized Coefficent	Std. Error	Standardized Coefficients *beta*	t-value
727	.196		3.705	(Constant)	.400	.147		2.723
3.405	.687	.156	4.952*	Building to lot size ratio	-2.711	.521	-.133	-5.200*
-7.894E-02	.045	-.056	-1.746**	Number of rooms	7.087E-02	.034	.050	2.085*
-196.209	54.285	-.177	-3.614*	Annual Property Tax Rate	185.898	35.925	.170	5.175*
-1.066E-02	.004	-.102	-2.645*	Year Property Built	1.582E-02	.003	.156	5.736*
.579	.436	.059	1.327	Movements from U to IS school districts (dummy)	-1.207	.318	-.113	-3.797*
.303	1.466	.006	.206	Movements from U to OS school districts (dummy)	.610	.221	.107	2.756*
-.236	.278	-.032	-.847	Movements from IS to IS school districts (dummy)	-.141	.223	-.017	-.634
1.139	1.486	.023	.766	Movements from IS to OS school districts (dummy)	2.203	.302	.201	7.286*
-1.287	.570	-.082	-2.259*	Movements from IS to U school districts (dummy)	.650	.488	.033	1.331
-.197	.216	-.040	-.913	Movements from OS to OS school districts (dummy)	.171	.163	.037	1.053
2.508	.322	.345	7.799*	Movements from OS to IS school districts (dummy)	-.785	.755	-.024	-1.039
.811	.355	.096	2.284*	Movements from OS to U school districts (dummy)	.223	.760	.007	.293
2.306E-05	.000	.031	.863	Population density (# of persons/square mile)	-3.116E-05	.000	-.053	-1.917**
-1.337	.389	-.144	-3.438*	Population growth rate (%, 90-97)	.274	.264	.032	1.041
-6.812E-06	.000	-.079	-1.566	Median households income ($)	1.538E-05	.000	.164	3.928*
2.200	.676	.111	3.252*	Median income growth rate (%, 90-97)	-1.762	.532	-.083	-3.310*
.876	.745	.043	1.176	Ethnicity (%, White/pop)	-8.451E-03	.465	-.001	-.018
.440	1.890	.012	.233	Youth population (%, 18 under/pop)	2.505	1.170	.079	2.140*
.589	1.315	.021	.448	Elderly population (%, 65 and over/pop)	-1.993	.935	-.075	-2.131*
-5.001	1.813	-.176	-2.759*	Married population (%, Married/pop)	7.974	1.297	.313	6.150*
.651	.968	.046	.672	Education (%, College+ Educated/25+ pop)	-1.700	.711	-.113	-2.392*
1.069	1.103	.062	.968	Occupation (%, White collar/economic pop)	-.246	.743	-.015	-.331
-.566	2.226	-.010	-.254	Housing Occupancy Rate (%, Occupied/HU)	6.421	1.449	.138	4.432*
.590	.588	.067	1.003	Housing Owner Occupancy Rate (%, Owner Occupied/HU)	-2.632	.422	-.306	-6.241*
.168	.019	.318	9.069*	Distance between sold and bought properties	.184	.013	.360	13.846*

a. Dependent Variable: IMF, IMF b. U: Urban, IS: Inner-Suburban, OS: Outer-Suburban * Significant at 5% level ** Significant at 10% level.

OMF Model: Housing-unit Factors

Similar to the IMF model, all property-specific variables were significant in the model of outward movement (OMF). However, the coefficients on the unit variables in the two models mirror one another—they have similar values but opposite signs. For OMF, larger movement distances away from the CBD were distinguished by significant *decreases* in the building-to-lot-size ratio, and significant *increases* in the number of rooms, the annual property-tax rate and the year property was built. Based on interpretation of standardized coefficients, the change in annual property-tax rate (tax paid over the assessed property value) is again the most important variable among the housing-unit predictors of OMF.

IMF Model: Neighborhood Factors

Among the spatial variables used to model inward migration, some of the school-district movement variables, the direct distance between sold and purchased properties, and several neighborhood characteristics, such as the differences in population-growth rate, income-growth rate, and marital status between the sold and bought neighborhoods, significantly accounted for IMF.

School-district location variables are central to this research because they illustrate how the juxtaposition of centrifugal and centripetal forces to the CBD works. In addition, their combination of widely varying tax rates and quality of service provided make them an important part of the structure of the metropolitan region. Among the eight paired school-district movement variables, three turned out to be significantly related to IMF (relative to the urban-to-urban comparison category). Inner-suburban-to-urban moves were related to shorter inward relocations (*i.e.,* weaker IMF) in comparison to urban-to-urban district moves (reflecting the size of the Columbus School District), while outer- suburban-to-inner-suburban moves and outer-suburban-to-urban moves were related to longer relocations than those within the Columbus School District. In general, these variables partially control for the geometry of the study area. However, they also demonstrate clear differences in movement magnitudes when school-district location is taken into account. Interestingly, the indicator variable controlling for outer-suburban-to-inner-suburban school district migration is the most important predictor of IMF among spatial variables (*beta*=0.345). Given the structural differences in outer-suburban and inner-suburban neighborhoods, migration flows may reflect the attraction of inner-suburban locations. These places have the best features of both urban and outer-suburban areas in terms of easy access to the urban center and high quality older neighborhoods, while still maintaining high residential and school quality comparable to outer-suburban locations.

Fewer than half of the spatial variables describing changes in neighborhood structure between bought and sold properties are significantly related to IMF. Comparing bought and sold properties, coefficients indicate that purchased properties in areas with lower population-growth rates, higher income-growth rates, and fewer married people are associated with larger inward moves. Of the significant neighborhood characteristics, based on the standardized coefficients, it is the change in the percentage of married couples that has the strongest relationships with IMF. However, the influence of change in income-growth rates as a structural force in the length of in-movement has interesting ramifications for gentrification and the momentum that it generates in a neighborhood.

Finally, the distance between sold and bought properties enters the IMF model with a positive sign. The interpretation of this coefficient is somewhat geometric: Houses purchased further from the sold property are also likely to be significantly closer to the CBD in an inward move. The magnitude of the standardized coefficient (0.318) suggests that is the second-most important factor in accounting for in-migration, behind the school district dummy.

OMF Model: Spatial Factors

A greater number of spatial variables significantly accounted for OMF than for IMF (see Table 3). This implies that the structure of outward migration perhaps depends more on neighborhood characteristics, while inward migration may be more attributable to housing-unit characteristics. For school-district location variables, urban-to-inner-suburban movement shows a negative sign (*i.e.,* it contributes to a shorter move length relative to the within urban district moves), while urban-to-outer-suburban and inner-suburban movements are positively related to OMF (*i.e.,* they have a positive impact relative to the urban-to-urban move). Inner-suburban-to-outer-suburban moves had the largest positive impact on OMF (relative to within-Columbus School District moves) among school district controls, as the corresponding indicator variable had the highest standardized coefficient.

Change in population density is negatively related to OMF. This finding is unsurprising and means that locations having lower population density were associated with longer moves away from the CBD. Indeed, low-density development characterizes outer-suburban communities and is often considered a key amenity (Jim 1998). Note that the change in the building-to-lot-size variable was also significant so the two density variables must be contributing somewhat differently to the explanation of OMF. Change in median household income is positively related to OMF, though the change in median income-growth rate has a negative relationship. This means that longer outward moves relative to the CBD terminated in neighborhoods having higher levels of income than those they originated in, yet rates of personal income growth in these neighborhoods were relatively low compared to the origin neighborhoods. The lower growth rate of income could be a function of the relatively higher base. Interestingly, areas of relatively higher income growth were related to IMF but not OMF. Considering other demographic variables, the difference in youth population percentage is positively related to OMF, while the change in percent elderly population and the college-educated population is negatively related to OMF. These variables probably also relate to the income and income-growth variable results.

Contrasting with the IMF model, two variables capturing neighborhood housing characteristics are significantly related to OMF. The change in housing-unit occupancy rate is positively related to OMF, while the change in housing-unit owner-occupancy rate exhibits a negative relationship with OMF. In other words, this suggests that migrants (all of whom are homeowners) will move farther to live in neighborhoods that have higher occupancy rates, yet have lower owner-occupancy rates, such as new rental communities. The change in owner-occupancy rate is relatively important (standardized coefficient of 0.306) and negative. This owner-occupancy change seems counterintuitive but may reflect the definition of neighborhood we are using. Perhaps block groups in newer suburban jurisdictions are more likely to have rental units contained in them than the kinds of neighborhoods that people move inward to achieve. Finally, the distance between bought and sold properties is positively related to OMF, which implies that longer-distance moves in absolute terms are likely to be farther away from the CBD. This variable was most important of all variables (*beta*=0.360) in accounting for OMF.

Discussion and Conclusion

We undertook this research in order to contribute to our understanding of how current urban structure (as represented by our independent variables) influences the magnitude of the distance moved by repeat homebuyers, whether the move reflects centrifugal forces or centripetal ones. The literature review focused on the importance of accessibility, residential and school quality, and the lifecycle demographics in different parts of the urban region.

Accessibility is handled in our analysis in our dependent variables measuring what we have called migration force—the magnitude (distance) of the move outward or inward made by each household. That magnitude is measured in terms relative to the location of the CBD, which we posit as the most important agglomeration of population and activity in the region. The relatively strong adjusted R-squared values indicate reasonably good fits in the models.

Given that the dependent variables describe a change in location, the independent variables are also defined as differences between the characteristics of the house and neighborhood sold and those of the house and neighborhood purchased. Our measures of change in residential quality (change in number of rooms, change in year built, and change in building-to-lot-size ratio) explicitly reflect the makeup of the housing stock in the county. Positive changes in rooms and year built, and declines in building-to-lot ratios, went along with stronger OMF, while the exact opposite characteristics predicted IMF.

The effect of the change in tax estimate in the two models is especially important from a policy point of view. Lower tax rates can clearly attract inward movers, and the lower the rate relative to those in the suburbs, the longer the distance over which the mover can be attracted. Of course, the level of taxes is related to the level of services provided, and schools are one of the most important services supported by the property tax.

We made no explicit effort to measure the quality of the different school districts, but we did separate them into three categories (urban, inner suburban, and outer suburban) and then examined the relationship between moves among those categories and the IMF and OMF measures (with urban-to-urban as the reference category). Not surprisingly, moves ending in suburban districts (especially outer districts) were most related to OMF. Moves ending in urban and inner-suburban districts were most related to IMF. The two within-category move types (inner-suburb-to-inner-suburb and outer-suburb-to-outer-suburb) did not have a significantly different effect in either case than the urban-to-urban move. These results support our decision to categorize the districts in this particular way. IMF and OMF follow from completely different sets of moves, but in much the way we would have predicted.

In terms of the difference in population characteristics of neighborhoods of origin and destination, there were more surprises. The change in median income and in income growth were significant for both OMF and IMF, but in opposite directions. That might not be too surprising given that difference in income is positive for OMF and negative for IMF. However the difference in income change has exactly the opposite signs, indicating that although smaller differences in income between origin and destination is related to IMF, the growth in income is higher in the destination than in the origin. Marital-status change is positive in association with OMF but negative with IMF. These variables have relevance to the issue of urban revitalization, specifically to gentrification. Households moving inward by larger amounts are decreasing their tax burden, moving into areas with relatively lower incomes, but these areas have higher income growth with fewer married households. The description could easily apply to most gentrifying neighborhoods.

Interestingly, neighborhood ethnicity is not significant in either case. This may indicate that repeat homebuyers are more concerned with class than race in choosing their destinations (though occupation and education were not consistently important in the two models). It may also reflect the structure of racial characteristics in the region as well—the kinds of housing units that repeat homebuyers sell or buy are, on the whole, not in minority neighborhoods (see Table 3).

The relationship of the structure of options for repeat homebuyers to OMF and IMF is conceptually linked to issues of sprawl and urban revitalization. Larger, lower density, newer houses with higher taxes in more outlying school districts are associated with stronger outward pushes (*i.e.,* relatively longer-distance moves). The neighborhoods have higher income but lower rates of income growth, mainly married couples, and a large young population. Housing is largely occupied, but not necessarily as heavily owner occupied as we might expect. Higher building-to-lot-size ratios, lower numbers of rooms and property-tax rates, as well as older buildings and more centrally located school districts, are associated with strong centripetal forces (IMF). Neither differences in housing-occupancy rates nor differences in homeownership rates make any difference to IMF. Income is lower in the destination neighborhoods, but income growth is higher, and the other population characteristics generally suggest gentrifying neighborhoods. Apparently, the characteristics of gentrifying areas can provide a significant enough centripetal force to bring in-movers from significant distances.

In policy terms, it seems clear that if the central city wishes to attract more repeat homebuyers as an urban revitalization scheme, it needs to focus on its strengths. These include an older housing stock, lower tax rates, and accessibility to CBD activities (both economic and social).

One of the main drawbacks of this study is the lack of information on the characteristics of the movers themselves or their motivations. Future research should try to incorporate survey work in order to match the characteristics and desires of the movers to the urban-structure variables that we studied in this article. The combination of the two would provide even better explanation of OMF and IMF. In addition, more detailed work could examine alternative or multiple population and job agglomerations and measure the migration force relative to those, rather than focusing on only one (albeit the major one). Finally, incorporation of different types of dwellings such as condominiums or duplexes may produce further interesting results.

Notes

[1]This index is created using the following formula: let P be the population at area j, and d_{ij} be the distances between areas, then population potential at area is

$$\Phi_i = \sum_j P_j \cdot d_{ij}^{-1}$$

[2]Using a nested F-test (see Chapter 10 of Ramsey and Schafer 1996 for this formulation), we test the null hypothesis that the spatial variables, including community characteristics, school districts, and direct distance between locations of bought and sold properties, have no effect on migration forces (MF) with aspatial (property-specific) effects entered into the model. The calculated *F*-statistic for the in-migration model (IMF) (19.723) (21 and 382 *df*) ($p < 0.001$), indicates that we may reject the null hypothesis and can conclude that a full IMF model with spatial variables significantly improves on a reduced IMF model without spatial variables. Using the same procedure, we concluded that spatial variables should be included in the model of out migration (OMF) as well.

References

Adair, A., S. McGreal, A. Smyth, J. Cooper, and T. Ryley. 2000. House Prices and Accessibility: The Testing of Relationships within the Belfast Urban Area. *Housing Studies* 15 (5): 699–716.

Adams, J. 1984. The Meaning of Housing in America. *Annals of the Association of American Geographers* 74 (4): 515–526.

Allen, W., D. Liu, and S. Singer. 1993. Accessibility Measures of United States Metropolitan Areas. *Transportation Research Part B: Methodological* 27 (6): 439–449.

Alonso, W. 1964. *Location and Land Use.* Cambridge: Harvard University Press.

Austin, D. 1999. Politics vs. Economics: Evidence from Municipal Annexation. *Journal of Urban Economics* 45: 501–532.

Benguigui, L., D. Czamanski, and M. Marinov. 2001. The Dynamics of Urban Morphography: The Case of Petah Tukvah. *Environment and Planning B: Planning and Design* 28 (3): 447–460.

Berger, M. 1996. Trajectories in Living Space, Employment and Housing Stock: The Example of the Parisian Metropolis in the 1980s and 1990s. *International Journal of Urban and Regional Research* 20 (2): 240–254.

Bier, T. and S. Howe. 1998. Dynamics of Suburbanization in Ohio Metropolitan Areas. *Urban Geography* 19 (8): 695–713.

Brasington, D. 2001. Capitalization and Community Size. *Journal of Urban Economics* 50: 385–395.

Brueckner, J. and R. Martin. 1997. Spatial Mismatch: An Equilibrium Analysis. *Regional Science and Urban Economics* 27 (6): 693–714.

Burnley, I. and P. Murphy. 1995. Residential Location Choice in Sydney Perimetropolitan Region. *Urban Geography* 16 (2): 123–143.

Cervero, R. 2001. Efficient Urbanization: Economic Performance and the Shape of the Metropolis. *Urban Studies* 38 (10): 1651–1671.

Cervero, R., T. Rood, and B. Appleyard. 1999. Tracking Accessibility: Employment and Housing Opportunities in the San Francisco Bay Area. *Environment and Planning A* 31 (7): 1259–1278.

Chan, S. 1996. Residential Mobility and Mortgages. *Regional Science and Urban Economics* 26 (3–4): 287–311.

Cho, C. 2001. Amenities and Urban Residential Structure: An Amenity-embedded Model of Residential Choice. *Papers in Regional Science* 80 (4): 483–498.

Ding, C. and R. Bingham. 2000. Beyond Edge Cities—Job Decentralization and Urban Sprawl. *Urban Affairs Review* 35 (6): 837–855.

Dwyer, C. and C. Sutton. 1994. Brown Plus 40—The Denver Experience. *Urban Geography* 15 (5): 421–434.

Eaglstein, A. and J. Weisberg. 1990. Categorical, Multivariate Analysis of Intraurban Migration. *Urban Studies* 27 (4): 509–517.

Fernandez, R. 1994. Race, Space, and Job Accessibility—Evidence from a Plant Relocation. *Economic Geography* 70 (4): 390–416.

Fong, E. and K. Shibuya. 2000. The Spatial Separation of the Poor in Canadian Cities. *Demography* 37 (4): 449–459.

Grubb, N. 1982. The Flight to the Suburbs of Population and Employment: 1960–1970. *Journal of Urban Economics* 11: 348–367.

Harris, C. 1954. The Market as a Factor in the Localization of Production. *Annals of the Association of American Geographers* 44 (4): 315–348.

Hassan, R., X. Zang, and B. McDonnell. 1996. Why Families Move: A Study of Residential Mobility in Australia. *Australian and New Zealand Journal of Sociology* 32 (1): 72–85.

Haurin, D. and D. Brasington. 1996. School Quality and Real House Prices: Inter- and Intrametropolitan Effects. *Journal of Housing Economics* 5 (4): 351–368.

Hite, D. 2000. A Random Utility Model of Environmental Equity. *Growth and Change* 31 (1): 40–58.

Horner, M. and T. Grubesic. 2001. A GIS-based Planning Approach to Locating Urban Rail Terminals. *Transportation* 28: 55–77.

Immergluck, D. 2001. The Financial Services Sector and Cities: Restructuring, Decentralization, and Declining Urban Employment. *Economic Development Quarterly* 15 (3): 274–288.

Jim, C. 1998. Impacts of Intensive Urbanization on Trees in Hong Kong. *Environmental Conservation* 25 (2): 146–159.

Johnson, M. 2001. Environmental Impacts of Urban Sprawl: A Survey of the Literature and Proposed Research Agenda. *Environment and Planning A* 33 (4): 717–735.

Khan, R., P. Orazem, and D. Otto. 2001. Deriving Empirical Definitions of Spatial Labor Markets: The Roles of Competing versus Complementary Growth. *Journal of Regional Science* 41 (4): 735–756.

Kim, D. and H. Chung. 2001. Spatial Location-allocation Model for Multiple Center Villages. *Journal of Urban Planning and Development—ASCE* 127 (3): 95–117.

Krugman, P. 1999. The Role of Geography in Development. *International Regional Science Review* 22 (2): 142–161.

Lee, S., D. Myers, and H. Park. 2000. An Econometric Model of Homeownership: Single-family and Multifamily Housing Option. *Environment and Planning A* 32 (11): 1959–1976.

Lee, W. and C. Roseman. 1997. Independent and Linked Migrants: Determinants of African American Interstate Migration. *Growth and Change* 28 (3): 309–334.

Leichenko, R. 2001. Growth and Change in U.S. Cities and Suburbs. *Growth and Change* 32 (3): 326–354.

Levinson, D. 1998. Accessibility and the Journey to Work. *Journal of Transportation Geography* 6 (1): 11–21.

Levy, J. 1994. *Contemporary Urban Planning*. Englewood Cliffs, N.J.: Prentice Hall.

Magdol, L. 2000. The People You Know: The Impact of Residential Mobility on Mothers' Social Network Ties. *Journal of Social and Personal Relationships* 17 (2): 183–204.

Main, M., F. Roka, and R. Noss. 1999. Evaluating Costs of Conservation. *Conservation Biology* 13 (6): 1262–1272.

Manson, G. and R. Groop. 2000. U.S. Intercounty Migration in the 1990s: People and Income Move Down the Urban Hierarchy. *Professional Geographer* 52 (3): 493–504.

Margulis, H. 2001. Household Mobility, Housing Traits, Public Goods, and School Quality in Cleveland's Metropolitan Statistical Area. *Urban Affairs Review* 36 (5): 646–677.

Martin, R. 2001. Spatial Mismatch and Costly Suburban Commutes: Can Commuting Subsidies Help? *Urban Studies* 38 (8): 1305–1318.

M'Bala, J. 2001. Forestalling Urban Sprawl: The Greber Plan for Montreal, 1950. *Urban History Review—Revue D Histoire Urbaine* 29 (2): 62–71.

Morrow-Jones, H. A. 1998. Repeat Homebuyers and American Urban Structure. *Urban Geography* 19 (8): 679–694.

———. 2002. Suburbanization, Mobility Processes, and Differences in the Motivations of Central City and Suburban Home Sellers and Buyers. Unpublished manuscript available from author.

Nelson, A. 1999. Comparing States with and without Growth Management—Analysis Based on Indicators with Policy Implications. *Land Use Policy* 16 (2): 121–127.

Nylund, K. 2001. Cultural Analyses in Urban Theory of the 1990s. *Acta Sociologica* 44 (3): 219–230.

Palivos, T. and P. Wang. 1996. Spatial Agglomeration and Endogenous Growth. *Regional Science and Urban Economics* 26 (6): 645–669.

Ramsey, F. and D. Shafer. 1996. *The Statistical Sleuth: A Course in Methods of Data Analysis*. Pacific Grove, Calif.: Duxbury Press.

Roseman, C. and S. Lee. 1998. Linked and Independent African American Migration from Los Angeles. *Professional Geographer* 50 (2): 204–214.

Sanchez, T. and C. Dawkins. 2001. Distinguishing City and Suburban Movers. *Housing Policy Debate* 12 (3): 607–631.

Shen, Q. 2001. A Spatial Analysis of Job Openings and Access in a U.S. Metropolitan Area. *Journal of the American Planning Association* 67 (1): 53–68.

Smith, V., C. Poulos, and H. Kim. 2002. Treating Open Space as an Urban Amenity. *Resource and Energy Economics* 24: 107–129.

So, K., P. Orazem, and D. Otto. 2001. The Effects of Housing Prices, Wages, and Commuting Time on Joint Residential and Job Location Choices. *American Journal of Agricultural Economics* 83 (4): 1036–1048.

Stern, M. and W. Marsh. 1997. The Decentered City: Edge Cities and the Expanding Metropolis. *Landscape and Urban Planning* 36 (4): 243–246.

Stoll, M., H. Holzer, and K. Ihlanfeldt. 2000. Within Cities and Suburbs: Racial Residential Concentration and the Spatial Distribution of Employment Opportunities across Sub-metropolitan Areas. *Journal of Policy Analysis and Management* 19 (2): 207–231.

Strand, J. and M. Vagnes. 2001. The Relationship between Property Values and Railroad Proximity: A Study Based on Hedonic Prices and Real Estate Brokers' Appraisals. *Transportation* 28 (2): 137–156.

Sundari, S. and M. Rukmani. 1998. Costs and Benefits of Female Labour Migration. *Indian Journal of Social Work* 59 (3): 766–790.

Tiebout, C. 1956. A Pure Theory of Local Expenditure. *Journal of Political Economy* 64 (5): 416–424.

Timar, J. and M. Varadi. 2001. The Uneven Development of Suburbanization during Transition in Hungary. *European Urban and Regional Studies* 8 (4): 349–360.

Tyrvainen, L. and H. Vaananen. 1998. The Economic Value of Urban Forest Amenities: An Application of the Contingent Valuation Method. *Landscape and Urban Planning* 43 (1–3): 105–118.

Waddell, P., B. Berry, and I. Hoch. 1993. Housing Price Gradients—The Intersection of Space and Built Form. *Geographical Analysis* 25 (1): 5–19.

Wang, F. 2001. Explaining Intraurban Variations of Commuting by Job Proximity and Workers' Characteristics. *Environment and Planning B: Planning and Design* 28 (2): 169–182.

Weimer, D. and M. Wolkoff. 2001. School Performance and Housing Values: Using Non-contiguous District and Incorporation Boundaries to Identify School Effects. *National Tax Journal* 54 (2): 231–253.

Wong, C., C. Tong, and S. Wong. 1999. The Development and Calibration of a Lowry Model with Multiple Market Segments. *Environment and Planning A* 31 (11): 1905–1918.